PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project	
Hanford Reach Steelhead Stock Investigation	
BPA project number	20023
Contract renewal date (mm/yyyy)	11/1/00, 11/1/02 (Multi-year)
Multiple actions? (indicate Yes or No)	No (but renewal of 00 will occur in 01,02,03)
Business name of agency, institution or organization requesting funding	
Washington Department of Fish and Wildlife	
Business acronym (if appropriate)	WDFW
Proposal contact person or principal investigator:	
Name	Keith Wolf, Fish Program Manager
Mailing address	1701 So. 24th Ave
City, ST Zip	Yakima, WA 98902
Phone	509 457 9330
Fax	509 575 2474
Email address	wolfksw@dfw.wa.gov
NPPC Program Measure Number(s) which this project addresses	
3.1B.11, 4.1A, 7.01B1, 701.C1,7.01C4, 7.1A1, 7.1B.1, 7.1C3, 7.1C4, 7.1D, 7.1H1,7.4C1	
FWS/NMFS Biological Opinion Number(s) which this project addresses	
Upper Columbia River Steelhead No. (Unavailable at this time) May also be dependent upon verification of stock origin(Mid Columbia Steelhead [proposed]; Snake River]). Biological Opion(s) would also apply if stock is listed is February 1999 and stock found to be genetically related. Upper Columbia River Section 10 permit No. 1094	
Other planning document references	
The Northwest Power Planning Councils Fish and Wildlife Program (including 1995 amendments);The Columbia River Fish Management Plan (renegotiation in process); *Wy-Kan-Ush-Mi-Wa-Kish Wit* (The Tribal Recover Plan); Wild Salmonid Policy; The Endandered Species Act; The National Marine Fisheries Service Biological Opinion(s) for upper Columbia River Steelhead; The National Marine Fisheries Service Biological Opinion(s) for Lower Columbia River Steelhead; The National Marine Fisheries Service Biological Opinion(s) for mid Columbia River Steelhead(proposed); The National Marine Fisheries Service Biological Opinion(s) for Snake River listed fall/spring/summer chinook; The Yakima Klickitat Fisheries Project; The Hanford Reach Juvenile Standing Study; The Mid-Columbia Habitat Conservation Plan	
Short description	
In 1998 a large number of concentrated spawning redds were observed in the Hanford Reach. These redds were observed during a time when only O. mykiss (Steelhead) typically spawn. This project intends to focus on species identification, stock delineation, stock status and monitoring, of an intermittent number of salmonid redds	

appearing in the Hanford Reach since 1962, and a large number (64) of localized concentration of redds observed in the Hanford Reach area near Locke Island (100 F area, White Bluffs). The 1998 occurrences compel us to initiate a directed program to identify this possible "founder population."

Target species

Onchorynchus mykiss - Anadromous life history form.

Section 2. Sorting and evaluation

Subbasin

Lower mid-Columbia River mainstem

Evaluation Process Sort

CBFWA caucus		CBFWA eval. process		ISRP project type	
X one or more caucus		If your project fits either of these processes, X one or both		X one or more categories	
X	Anadromous fish	X	Multi-year (milestone-based evaluation)		Watershed councils/model watersheds
X	Resident Fish	X	Watershed project eval.	X	Information dissemination
	Wildlife				Operation & maintenance
					New construction
				X	Research & monitoring
				X	Implementation & mgmt
					Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20510	Yakima/Klickitat Fisheries Project (95061)
9701400	Hanford Reach Juvenile Stranding Study

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
	N/A, new project	

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task

Obj 1,2,3	Objective	Task a,b,c	Task
1	Development of protocol and experimental design. Conduct aerial redd count surveys. Conduct in-river redd monitoring.	a, b, c, d	Develop multi-year plan to establish stock delineation, sampling methods, statistical analysis and management response. Aerial surveys. In-river redd monitoring.
2	Development of methodology	a	Develop methods to detect and mark redds.
3	Development of method	a, b, c, d	Develop method to locate redds and extent of spawning distribution, spawn timing and life-history patterns.
4	Development of methodology‘	a, b	Develop methods to extract and analyze genetic material (DNA).
5	Implementation of methodology	a, b	Extract and analyze genetic material
6	Verification of species	a	Verify Onchorynchus mykiss the spawning species
7	Discriminate habitat preferences and utilization	a, b	Identify habitat preferences, condition and utilization patterns.
8	Assess habitat condition	a	Assess limiting or contributing factors for stock condition and status
9	Verification of stock‘	a	Establish progenitor stock(s)
10	Enable active fisheries management	a	Produce GIS spawning distribution layer
11	Enable active fisheries management	a	Initiate stock status and trend analysis
12	Enable active fisheries management	a, b	Monitor stock status and trend analysis. Develop and implement fisheries management, including risk and limiting factor analysis.
13	Implement active fisheries management	a, b, c	Establish escapement goals, production level (if applicable), and harvest allocation
14	Coordinate ESA activities	a	Compliance with applicable ESA requirements

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measurable biological objective(s)	Milestone	FY2000 Cost %
1	11/1/99	05/00	Development of peer reviewed experimental design and conduct aerial redd counts in Hanford Reach and locate in-river	Implementation of experimental design. Collection of data.	5%
2	11/1/99	06/00	Marking and relocation of redds before loss of visual detect ability	Marking and relocation of actual redds	5%
3	11/1/99	06/99	Utilize objectives 1 and 2 to determine extent and range of actual redd development and spawning of alleged stock	Baseline data development of spawning distribution	10%
4	12/1/99	04/00	Develop methodology to extract eggs from redds at the eyed-egg stage for archival and DNA analysis. Statistical power analysis development	Methodology to obtain baseline data development of genetic lineage for this stock	5%
5	04/00	06/00	Extract sufficient number of eggs from sufficient number of redds at the eyed-egg stage for	Obtain baseline data development of genetic lineage for	25%

Obj #	Start date mm/yyyy	End date mm/yyyy	Measurable biological objective(s)	Milestone	FY2000 Cost %
			archival and DNA analysis	this stock	
6	04/00	11/00	Collection of genetic material sufficient to verify species as O. mykiss	Verification of O. mykiss spawning in Hanford Reach	5%
7	04/00	06/04	Develop methodology to determine habitat preferences, condition and utilization patterns	Assessment of habitat preferences, condition and utilization patterns to develop management options and identify limiting factors	5%
8	04/00	06/04	Establish limiting factors for stock through habitat preference, condition and utilization patterns	Known limiting factors for stock, habitat preference, condition and utilization patterns	5%
9	04/00	10/04	Comparisons of genetic materials to known steelhead stocks	Establishment of genetic stock lineage	10%
10	04/00	10/04	Collect data on spawning distribution and range for this stock	GIS layer for spawning distribution and range	10%
11	04/00	10/04	Collect data on redd counts, survival rates and adult returns	Initiate stock status and trend analysis	10%
12	04/03	10/04	Collect data on redd counts, survival rates and adult returns	Monitor, update and verify stock status.	0
13	04/02	10/04	Collect data on redd counts, survival rates and adult returns	Establish escapement goals, reach productivity and harvest allocation.	0
	04/02	10/04	Collect data on redd counts, survival rates and adult returns	Monitor applicability of escapement goals, harvest levels	0
15	04/02	10/04	Collect data on redd counts, survival rates and adult returns	Compliance with applicable ESA requirements	0
				Total	100%

Schedule constraints

FY 99 work cannot be initiated under BPA funding. FY 00-03 constraints will be established by funding and availability of staff resources, cost-sharing and unforseen environmental conditions.

Completion date

October, 2003

Section 5. Budget

FY99 project budget (BPA obligated):	$ **0**

FY2000 budget by line item

Item	Note	% of total	FY2000 ($)
Personnel	1- Project Supervisor (PM @1.5 mo.); 1 Principle Investigator (bio 4 @3.0 mo.); 3 Tech Temp (21-staff week total); termination leave for Tech Temps (@ 21 week total)	.73	72,235.00
Fringe benefits	Retirement only (other incl. above)	.03	3,285.00
Supplies, materials, non-expendable property	Postage, copies, telephone and fax, printing, photography/processing	.02	1,900.00
Operations & maintenance	OM of sampling materials, boats,	.01	800.00
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	Office space rental @ 150/mo. (3 FTE's x 2.17 months)	.01	975.00
NEPA costs		0	0
Construction-related support	Engineering of redd marking methods and temp SCUBA sampling platform (in-river)	.0031	300.00
PIT tags	# of tags: 62 (Blank pit) (BPA to purchase)	.0020	180.00
Travel	2 personnel x 10 days/year (per diem)	0.03	2,500.00
Indirect costs	WDFW Administrative overhead @ .20	0.16	15,370.00
Subcontractor	SCUBA sampling of redds/season (1,500/day @ 3 days per year), aerial survey Battelle Northwest Laboratories (subrecipient)	.05	4,500
Other	Genetic sampling @ 75.00 sample	.01	4,725.00
TOTAL BPA REQUESTED BUDGET (less cost sharing below [$6,950.00])			**$98,820.00**

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
Battelle Northwest	Aerial survey	0.01	1,000.00
WDFW	Data analysis, baseline genetic collection and analysis of Snake and Upper Columbia River steelhead stocks	0.03	2,700.00
Yakama Indian Nation/WDFW (YKFP)	Baseline genetic collection and analysis of Yakima stocks	0.01	675.00
Other Col. Tribes (Umatilla, Warm Springs, Nez Perce)	Baseline genetic collection and analysis of other stocks	0.01	675.00
CRITFC	Review of genetic profile	0.02	1,900.00
Total project cost (including BPA portion)			**$108,470.00**

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$98,820 (same as FY 00)	$89,681.00 (lower personnel and development costs)	$83,850.00 (lower personnel and development costs)	$0 (Project completed in 2003)

Section 6. References

Watershed?	Reference

	Duauble, Dennis 1998 Battelle Northwest Laboratories - pers. comm
	Dauble et,. al. 1998 Battelle Northwest Laboratories. Aerial observations of Hanford Reach
x	The Northwest Power Planning Council Fish and Wildlife Program (including 1995 amendments).
x	NMFS 1998 Upper Columbia River Steelhead Biological Opinion-1998
x	The Spirit of the Salmon (Tribal Recovery Plan)
x	Columbia River Fish Management Plan , 1985 (currently renegotiating, 1998-99)
x	Endangered Species Act-1976
x	The Artificial Production Review, NPPC 1998 - Draft
x	Wild Salmonid Policy-WDFW, 1998

PART II - NARRATIVE

Section 7. Abstract

We intend to focus on species identification, stock delineation and stock status and monitoring of a scientifically derived number of salmonid redds appearing intermittently in the Hanford Reach since 1962. In 1998 a large number (64) of localized concentration of redds were observed in the Hanford Reach area near Locke Island (100 F area, White Bluffs) in 1998. This high level of localized spawning compels the basin to initiate a directed program to identify this possible "founder population." These redds were observed during a time when only Onchoryhchus. mykiss (anadromous life history form/Summer Steelhead) typically spawn and at a time when no other salmonid species are know to spawn in the Hanford Reach. Collections of genetic material from redds marked and located within the spawning population will be compared with other baseline genetic information on Columbia River stocks to determine 1. Speciation, 2. Stock origin, and, 3. Stock status. Development of appropriate fishery management actions are inextricably dependent upon completion of these abstract objectives.

Section 8. Project description

a. Technical and/or scientific background

This project will be conducted by the Washington Department of Fish and Wildlife in conjunction with Columbia River treaty tribes, the National Marine Fisheries Service, Battelle Northwest Laboratories and other contributing and review entities. The project will be overseen Mr. Keith Wolf, Fish Program Manager for South Central Washington and WDFW's Yakima Klickitat Fisheries Project Policy Representative. Dr. Jim Shaklee (WDFW) will oversee the genetic analysis of the source material. The principle investigator will be Mr. Paul Wagner, a WDFW staff member from South Central Washington with many years of experience in the Hanford Reach and with large-scale project management. Finally, Mr. Jim Cummins, South Central Washington District Biologist for WDFW, will act as the fish management biologist for the project. In addition to utilization of WDFW's genetic analysis and statistical design staff, the agency will consult with several Washington treaty tribes, Battelle Northwest Laboratories and other prominent experts in fisheries.

b. Rationale and significance to Regional Programs

This project has extremely far-reaching implications in terms of almost all Columbia River regional programs including The Endangered Species Act; The Columbia River Fish Management Plan, the Northwest Power Planning Council's Fish and Wildlife Plan, The Governor's Salmon Recovery Plan, Wild Salmonid Policy, the Tribal Recovery Plan, Several of The National Marine Fisheries Service's current, proposed and future Biological Opinions, and preceding Biological Assessments. Also, the project in integral to validate many of these plans assumptions. Designation of this stock in the Salmon and Steelhead Stock Inventory (SASSI) and the subsequent monitoring of this stock's trends, development of escapement goals and harvest regimes signify it's relevance to a very large proportion of the Regional Programs currently in place, under development or envisioned in the near future.

c. Relationships to other projects

Links to ongoing projects will only be possible upon completion of the goals and objective of this project. The spawning population could be linked to a large number of ongoing projects when stock composition and origin are determined. Likely links could be the Yakima Klickitat Fisheries Project, The Artificial Production Review, a number of existing, proposed and anticipated Biological Opinions from the National Marine Fisheries Project and the Northwest Power Planning Councils Fish and Wildlife Program itself.

The Council received a number of comments in the 1994 (1995) amendment process supporting better monitoring and evaluation programs, some in favor of CRITFC's proposal to place the fishery managers in the firmest control of monitoring, evaluation and scientific assessment; some in favor of continued emphasis on independent scientific evaluation. The Columbia Basin Fish and Wildlife Authority (CBFWA) generally supported the CRITFC recommendation. CBFWA said the Council should establish a monitoring program to address both progress toward rebuilding goals and individual indicator stocks, as identified by the Council.

The general principles to govern the monitoring program should include: projects to help reduce uncertainties; priorities that reflect system wide analysis of major uncertainties; BPA and the Corps' funding to be consistent with key uncertainties; knowledge to be reviewed by fish managers and made available to others; fish managers will participate in development and implementation of monitoring program; BPA and other project operators will fund monitoring; and projects are to be coordinated with activities of others. Fish managers should evaluate the program, although the fish managers should continue to work with the Scientific Review Group, the independent scientific group established by BPA as part of its implementation and funding process. Several other Bonneville Power Administration projects e.g., the Hanford Reach Juvenile Stranding Study and others are also plausible candidates.

d. Project history N/A

e. Proposal objectives

To verify a new steelhead population in the Hanford Reach by monitor spawning of this proposed stock and conduct collections of genetic material from redds marked and located within the spawning population. These will be compared with other baseline genetic information on Columbia River stocks to determine, in general, 1. Speciation, 2. Stock origin, and, 3. Stock status. Fifteen specific objectives are identified in Section 4 of this document and contain detailed descriptions.

Further, the proposal objectives are designed to result in development of appropriate fishery management actions, rebuilding goals and ongoing management plans that are inextricably linked and dependent upon completion of the project objectives.

f. Methods

Primarily, DNA genetic analysis (microsatellite) will be used to determine species, stock origin and composition. WDFW has state-of-the-art laboratory facilities in Olympia Washington to carry out this analysis. The WDFW DNA lab is equipped to do both microsatellite DNA analysis (doing standard size variation analysis) and DNA sequencing using an Applied Biosystems (ABI-377) semiautomated DNA sequencer. We are able to work with small biopsy tissue samples because we utilize PCR (polymerase chain reaction) methods to amplify the DNA that is extracted from the tissue samples. Since setting up the DNA laboratory, we have initiated microsatellite DNA studies of bull trout and Dolly Varden, chum salmon, chinook salmon, and common murre.

Dr. James Shaklee (CV below) will be overseeing the laboratory analysis. Genetic staff from WDFW will evaluate and develop a stock profile. Staff from CRITFC will review this information.. WDFW staff will collaborate with Battelle Northwest Laboratories to conduct ongoing aerial surveys during the spring spawning period. Blank pit Tags will be used to mark observed redds to relocated them at a future date in order to conduct the in-river genetic sampling. A certified and bonded SCUBA company or entity will be subcontracted in order to obtain up to three eyed-egg samples from a predetermined number of random redds throughout the spawning area and population. Statistical design for this project will be developed by WDFW biometric staff.

g. Facilities and equipment

Project headquarters will be located at WDFW's district office in Kennewick Washington. Regional Supervision will be conducted from the South Central Washington Regional Office in Yakima, Washington. Genetic analysis and supervision will be conducted from the Olympia Headquarters office.

Equipment will be engineered and obtained according to the proposed budget and consist of modifications made to existing boating and sampling equipment. These modifications will be consistent with what will be required to conduct in-river location of redds and recovery of genetic material. Computer, fax, phone, copiers etc. are currently available under existing WDFW equipment. Operation and maintenance and additional needs are reflected in the proposed budget.

h. Budget

The main budget items consist of costs associated with personnel, scientific design; spawning range and distribution; habitat preference and condition; obtaining genetic material; analyzing genetic material and implications associated with The Endangered Species Act for modifications to Biological Assessments and Biological Opinions.

Section 9. Key personnel

1. Keith Wolf: Education: Whatcom Community College-Bellingham, Washington. General college core education, 1986-1988; Western Washington University-Bellingham, Washington. Marine Biology/Fisheries Science, 1988-1991; Pacific Lutheran University-Tacoma, Washington. Bachelor of Science - Marine Biology, 1991; Columbia Pacific University-San Rafael, California. Masters of Science - Marine Biology/Animal behavior 1991-1992 (32 graduate credits)

Professional Experience: Washington Department of Fish and Wildlife. Fish Management Program Region 3, South Central Washington. **Position:** Fish Program Manager/Yakima Klickitat Fisheries Project Policy Representative. January 1997-present: Immediate Supervisor: F. Dale Bambrick, Regional Director. (509) 457-9316

Full responsibility to manage and implement the agency's Fish Management Program in Region three, including the management of fish resources in the lakes and streams for preservation, perpetuation, enhancement, restoration; to provide fish related recreation; provide policy decisions with other agency programs, private landowners, citizens, industry and local, state, federal , and international agencies. Directs the activities of thirteen supervisory staff and up to 70 additional professional positions. Annual budget of 3.4 million dollars. Also, currently serving as the WDFW's policy representative of the Yakima Klickitat Fisheries Project. Independent lead development and negotiation and implementation of agency policy goals, objectives and strategies for this project. The YKFP is a large, multi-agency fish restoration, production and evaluation program that involves significant capital investment in salmon rearing and acclimation facilities, preeminent research design, adaptive management principles, and complex project management structure. Position leads, coordinates and manages related resource policy intent with related Columbia River basin and statewide policies and guidelines such as, Yakama Indian Nation; Bonneville Power Administration; the Northwest Power Planning Council; the Columbia Basin Fish and Wildlife Authority; agency administration; and policy and technical staff to insure appropriate project direction, implementation and evaluation. Annual project budget of 9-14 million dollars.

Other:

Washington Department of Fish and Wildlife. Fish Management Program/Inland Fish Division, Olympia Washington. **Position:** Western Washington Management Biologist (Fish Biologist 3). April 1996-January 1997. Immediate Supervisor: Craig Burley (360) 902-2406

Washington Department of Fish and Wildlife. Fish Management Program/Anadromous Fish Division, Olympia Washington. **Position:** Puget Sound Harvest Evaluation Coordinator (Fish Biologist 3). October 1993-April 1996. Immediate Supervisor: Teresa Scott (360) 902-2713

Washington Department of Wildlife. Fish Management Program/Inland Fish Division. **Position:** Mid Columbia Predator Index Study (Fish Biologist 1). March 1993-October 1993. Immediate Supervisor: John Loch.

Ardea Enterprises, Inc. Position: Marine Biologist/Staff Scientist. Seattle, Washington. Immediate Supervisor: Michael Kyte. August 1989-October 1992

Pacific Rim Shark Studies Center. Point Defiance Zoo and Aquarium, Tacoma Washington. **Position:** Co-founder, affiliate researcher. Contact: John Rupp, Curator of Fishes. August 1990-present.

Publications:

Wolf, K.S. 1993. *Finning and Other Destructive Modes of Inefficient Development in the shark Fishery*. In: Chondros. Volume 4: Number 3.

Wolf, K.S. et., al. 1996. *Seabird Mortality in Puget Sound Commercial Salmon Fisheries. In: Proceedings, Solving Bycatch,* Solutions for Today and Tomorrow. Alaska Sea Grant Program.

Wolf, K.S. 1998. *Under Puget Sound*. Professional video documentary featuring comprehensive aspects of underwater ecosystem in Washington State. The Emerald Oceans Production Group Inc.

Camhi, M Fowler, S.L. Musick, J.A. Brautigam, A. and Fordham S.V. (1998) *Sharks and their Relatives - Ecology and Conservation*, IUCN/SSC Shark Specialist Group. UUCN, Ggland, Switzerland and Cambridge, UK iv + 39 pp (acknowledgement and contributor).

Wolf, K.S. 1998 *Sharks of Puget Sound*. In process.

Professional Training and Certifications: Sixteen professional certifications.

Memberships and Affiliations: World Shark Specialist Group-IUCN; American Elasmobranch Society; American Fisheries Society; American Institute of Fishery Research Biologists; American Institute of Biological Sciences; Pacific Rim Shark Studies Center; Point Defiance Zoo and Aquarium

2. Paul Wagner::**EDUCATION:** Degrees Earned: B.S. Fisheries Management. University of Washington. Seattle.1983.

Current Employer: Washington Department of Fish and Wildlife. Relationship to Project: Paul Wagner is the project leader of this

evaluation. He is responsible for overall development of study designand budget management, study implementation, oversight of subcontracted parties, analysis of data, supervision of WDFW staff, interim and final report writing, and coordination with collaborating agencies and affected parties.

Employment History: Paul Wagner began employment with the Washington Department of Fish and Wildlife in 1983. He began work for WDFW under federal contracts in 1987 at McNary Dam as the Fish Transportation Oversight Team (FTOT) representative. He has extensive experience in juvenile fall chinook thermal mortality assessment at McNary Dam and initiated the thermal profiling procedure currently in effect at that project. In 1990 he became the McNary Smolt Monitoring Program supervisor and began conducting independent and cooperative research projects for WDFW under federal contracts that same year. Most noteworthy research included the 1990 and 1991 evaluations of adult fallback at McNary Dam. In 1992, he initiated the first PIT tagging project for wild upriver bright fall chinook on the Hanford Reach which was later incorporated into the Smolt Monitoring Program. He has been a member of the Vernita Bar Monitoring Team for determination of critical flows for the protection of pre-emergent fall chinook in the Hanford Reach since

1987. Currently under federal contracts, he acts as the WDFW project leader in juvenile passage related research in the Columbia basin. He also supervises Smolt Monitoring Program, Gas Bubble Trauma Monitoring, and Transportation/Bypass System Quality Control at McNary, Ice Harbor, and Lower Monumental Dams.

Publications:

Wagner, P. 1990 McNary Dam Smolt Monitoring Program. Annual Report. State of Washington. Department of Fisheries. Habitat Management Division. Prepared for United States Department of Energy. Bonneville Power Administration. Division of Fish and Wildlife. Project Number 87-127. Contract Number DE-FC79-88BP38906. 20 pages.

Wagner, P. 1990 Evaluation of The Use of The McNary Bypass System To Divert Adult Fallbacks Away From Turbine Intakes. State of Washington. Department of Fisheries. Habitat Management Division. Report to United States Army Corps of Engineers. Modification to Contract Number DACW-68-82-C-0077. Task Order Number 9. 72 pages.

Wagner, P. 1991 McNary Dam Smolt Monitoring Program. Annual Report. State of Washington. Department of Fisheries. Habitat Management Division. Prepared for United States Department of Energy. Bonneville Power Administration. Division of Fish and Wildlife. Project Number 87-127. Contract Number DE-FC79-88BP38906. 40 pages.

Wagner P., and T. Hillson. 1991 Evaluation of Adult Fallback Through The McNary Dam Juvenile Bypass System. State of Washington. Department of Fisheries. Habitat Management Division. Report to United States Army Corps of Engineers. Contract Number DACW-68-82-C-0077. Task Order Number 10. 79 pages.

Nelson W., D. Rondorf, and P. Wagner. Subyearling Chinook Salmon Marking at McNary Dam to Estimate Adult Contribution. 1992. United States Fish and Wildlife Service. Columbia River Research Laboratory. Washington Department of Fisheries. Habitat Management Division. Annual Report to The Bonneville Power Administration. 13 pages.

3. James L. Cummins:

EDUCATION: Name of Degree Bachelor of Science Year(s) 1968-1970 UNIVERSITY OF WASHINGTON CITY, STATE SEATTLE, WA *Major :*Fisheries Science *Minor:* Minor fields of study include marine biology and statistics.

Name of Degree Associate Arts and Sciences

Year(s) 1966-1968 INSTITUTION NAME COLUMBIA BASIN COMMUNITY COLLEGE CITY, STATE PASCO, WA *Major:* General studies

EMPLOYMENT: Job Title: District Fish Biologist 1996- present. Extensive duties overseeing all fish program management in Benton and Franklin Counties.

Job Title: Regional Fish Biologist Year(s) 1994-1996 ORGANIZATION NAME WASHINGTON DEPARTMENT OF FISH AND WILDLIFE CITY, STATE YAKIMA, WA

Responsibilities and accomplishments. Responsible for the preservation, enhancement and protection of the inland fishery resources within Benton, Kittitas, Klickitat and Yakima Counties. Direct the activities of a fishery biologist and temporary technicians. Coordinate inland fish division activities with all agency programs and divisions, other state agencies, federal agencies, the Yakima Indian Nation and other entities. Plan, develop and monitor regional inland fish work plans. Act as a lead expert on regional inland fish management issues. Collect biological data and develop management recommendations, including fishing regulations. Serve as a member of the regional staff. Diversified recreational fishing opportunity by introducing channel catfish in a number of lowland lakes. Manage a budget. These and other activities, are being accomplished in an efficient and professional manner.

Job Title: Fisheries Resource Program Manager Year(s) 1981-1993 ORGANIZATION NAME WASHINGTON DEPARTMENT OF WILDLIFE CITY, STATE YAKIMA, WA

Responsibilities and accomplishments. Responsible for the preservation, enhancement and protection of the fisheries resource (except food fish) within Benton, Chelan, Kittitas and Yakima Counties. Responsibilities and accomplishments were generally the same as for my current regional fish biologist job (described above), except for the added responsibilities of managing steelhead, directing two area fish biologists, three hatchery managers and temporary technicians and serving as a member of the regional staff with a role in making staff decisions. Also, for several years, investigated and wrote hydraulic permits, commented on forest practices applications and reviewed environmental permits; participated in interagency subbasin planning process and in the Yakima supplementation hatchery planning process. Initiated aggressive wild trout management programs and bull trout harvest restrictions and monitoring before bull trout were in the spotlight. Diversified recreational fishing by initiating introduction of brown trout in numerous lowland lakes.

Job Title Area Fish Biologist Year(s) 1975-1981 ORGANIZATION NAME WASHINGTON DEPARTMENT OF GAME CITY, STATE PUYALLUP, WA

Responsibilities and accomplishments. Under the direction of the regional fish biologist, responsible for preservation, enhancement and protection of the fisheries resource (except food fish) within Pierce and King Counties. The geographic area of responsibility changed slightly over time. Collected biological data (creel census, high lake surveys, stream electrofishing surveys, kokanee and steelhead spawning surveys, etc.) Assisted fish hatcheries and planted fish. Attended sports club and civic meetings. Wrote management reports and made management recommendations, including fish planting allotments, lake rehabilitation projects, and fishing regulations. Surveyed approximately 100 high lakes and wrote several reports on those surveys. Investigated and wrote hydraulics permits and reviewed environmental document

Job Title Area Fish Biologist Year(s) 1972-1974 ORGANIZATION NAME WASHINGTON DEPARTMENT OF GAME CITY, STATE OLYMPIA, WA

Responsibilities and accomplishments. Under the direction of the regional fish biologist, responsible for preservation, enhancement and protection of the fisheries resource (except food fish) within Thurston, Pierce and Lewis Counties. Collected biological data (creel census, high lake surveys, stream electrofishing surveys, kokanee and steelhead spawning surveys, etc.) Assisted fish hatcheries and planted fish. Attended sports club and civic meetings. Wrote management reports and made management recommendations, including fish planting allotments, lake rehabilitation projects, and fishing regulations. Investigated and wrote hydraulic permits, commented on forest practiced applications and reviewed environmental documents. At that time the fish management division handled activities currently handled by the habitat program. Surveyed approximately 50 high lakes and wrote a report on those surveys.

Job Title Fish and Game Technical Aide Year(s) 1970-71 ORGANIZATION NAME WASHINGTON DEPARTMENT OF GAME CITY, STATE BELLINGHAM, WA

Responsibilities and accomplishments. Assisted with kokanee egg take and operated Lake Whatcom Hatchery. Designed a creel census to estimate total harvest and effort and conducted a creel census at Baker lake in 1971.

Job Title Fish Culturist 1 Year(s) 1970 ORGANIZATION NAME WASHINGTON DEPARTMENT OF GAME CITY, STATE AZWELL., WA

Responsibilities and accomplishments. Fed fish, cleaned raceways at Wells fish hatchery and planted fish. Planted in excess of 50,000 catchable trout in the Metthow River and tributaries.

Total of twenty-six years of experience in all aspects of fisheries and project management.

4. Dr. James Shaklee: Washington Department of Fish & Wildlife, 600 Capitol Way N.Olympia, Washington 98501-1091 Phone: (360) 902-2752; FAX: 360-902-2944; E-mail: <shakljbs@dfw.wa.gov>

PRESENT POSITION Research Scientist (Washington Department of Fish andWildlife)

EDUCATIONAL BACKGROUND

B.S. Zoology (1968) Colorado State University

M.Phil. Biology (1970) Yale University

Ph.D. Biology (1972) Yale University

M.S. Fishery Biology (1974) Colorado State University

MEMBERSHIP IN PROFESSIONAL SOCIETIES

American Fisheries Society

American Society of Ichthyologists and Herpetologists

Society for the Study of Evolution

PROFESSIONAL EXPERIENCE

1972-1973 Postdoctoral Research Associate; University of Illinois (with Dr. Gregory S. Whitt)

1974 Assistant Professor (temporary); Department of Zoology and Entomology; Colorado State University

1974-1975 Postdoctoral Research Associate; University of Illinois (with Dr.Gregory S. Whitt)

1975-1981 Assistant Professor; Department of Zoology, University of Hawaii

Assistant Marine Biologist; Hawaii Institute of Marine Biology

1981-1985 Senior Research Scientist; CSIRO Division of Fisheries Research;Cleveland, QLD, AUSTRALIA

1985-1987 Fishery Biologist 4; Washington Department of Fisheries

1987- Research Scientist; Washington Department of Fisheries.

PUBLICATIONS

Papers Published in Refereed Journals

Shaklee, J.B., K.L. Kepes, and G.S. Whitt. 1973. Specialized lactate dehydrogenase isozymes: the molecular and genetic basis for the unique eye and liver LDHs of teleost fishes. J. Exp. Zool. 185:217-240.

Whitt, G.S., E.T. Miller, and J.B. Shaklee. 1973. Developmental and biochemical genetics of lactate dehydrogenase isozymes in fishes. pp. 243-276. In: (J.H. Shroder, ed.) Genetics and Mutagenesis of Fish. Springer-Verlag, New York, 356 pp.

Shaklee, J.B., M.J. Champion, and G.S. Whitt. 1974. Developmental genetics of teleosts: a biochemical analysis of lake chubsucker ontogeny. Dev. Biol. 38: 356-382.

Shaklee, J.B. 1975. The role of subunit interactions in the genesis of non-binomial lactate dehydrogenase isozyme distributions. pp. 101-118. In: (C.L. Markert, ed.) Isozymes, I. Molecular Structure. Academic Press, New York, 856 pp.

Champion, M.J., J.B. Shaklee, and G.S. Whitt. 1975. Developmental genetics of teleost isozymes. pp. 417-437. In: (C.L. Markert, ed.) Isozymes, III: Developmental Biology. Academic Press, New York, 1034 pp.

Whitt, G.S., J.B. Shaklee, and C.L. Markert. 1975. Evolution of the lactate dehydrogenase isozymes of fishes. pp. 381-400. In: (C.L. Markert, ed.) Isozymes IV: Genetics and Evolution. Academic Press, New York, 965 pp.

Markert, C.L., J.B. Shaklee, and G.S. Whitt. 1975. The evolution of a gene. Science 189: 102-114.

Whitt, G.S., W.F. Childers, J.B. Shaklee, and J. Matsumoto. 1976. Linkage analysis of the multilocus glucosephosphate isomerase isozyme system in sunfish (Centrarchidae, Teleostei). Genetics 82:35-42.

Shaklee, J.B., J.A. Christiansen, B.D. Sidell, C.L. Prosser, and G.S. Whitt. 1977. Molecular aspects of temperature acclimation in fish: contributions of changes in enzyme activities and isozyme patterns to metabolic reorganization in the green sunfish. J. Exp. Zool. 201:

Shaklee, J.B. and G.S. Whitt. 1977. Patterns of enzyme ontogeny in developing sunfish. Differentiation 9: 85-95.

Fisher, S.E., J.B. Shaklee, S.D. Ferris, and G.S. Whitt. 1980. Evolution of five multilocus isozyme systems in the chordates. Genetica 52/53: 73-85.

Shaklee, J.B. and C.S. Tamaru. 1981. Biochemical and morphological evolution of Hawaiian bonefishes (Albula). Syst. Zool. 30:125-146.

Shaklee, J.B. and G.S. Whitt. 1981. Lactate dehydrogenase isozymes of gadiform fishes: divergent patterns of gene expression indicate a heterogeneous taxon. Copeia 1981: 563-578.

Shaklee, J.B., C.S. Tamaru, and R.S. Waples. 1982. Speciation and evolution of marine fishes studied by the electrophoretic analysis of proteins. Pac. Sci. 36: 141-157.

Shaklee, J.B. 1983. Mannosephosphate isomerase in the Hawaiian spiny lobster (Panulirus marginatus): a polymorphic, sex-linked locus useful in investigating embryonic and larval sex ratios. Mar. Biol. 73: 193-201.

Shaklee, J.B., R.W. Brill, and R. Acerra. 1983. Biochemical genetics of Pacific blue marlin (Makaira nigricans) from Hawaiian waters. NOAA Fish. Bull. 81: 85-90.

Shaklee, J.B. 1983. The utilization of isozymes as gene markers in fisheries management and conservation. pp. 213-247. In: (M.C. Rattazzi, J.G. Scandalios, and G.S. Whitt, eds.) Isozymes: Current Topics in Biology and Medicine. Vol. 11. Academic Press, New York.

Shaklee, J.B. 1984. Genetic variation and population structure in the damselfish, Stegastes fasciolatus, throughout the Hawaiian Archipelago. Copeia 1984:629-640.

Shaklee, J.B. and P.B. Samollow. 1984. Genetic variation and population structure in a spiny lobster (Panulirus marginatus) in the Hawaiian Archipelago. NOAA Fish. Bull. 82:693-702.

Shaklee, J.B. and P.B. Samollow. 1984. Genetic variation and population structure in a deepwater snapper (Pristipomoides filamentosus) in the Hawaiian Archipelago. NOAA Fish. Bull. 82:703-713.

Shaklee, J.B., and J.P. Salini. 1985. Genetic variation and population subdivision in Australian barramundi, Lates calcarifer. Aust. J. Mar. Freshw. Res. 36:203-218.

Keenan, C.P. and J.B. Shaklee. 1985. Electrophoretic identification of raw and cooked fish fillets and other marine products. Food Technol. Aust. 37(3):117-128.

Shaklee, J.B. and C.P. Keenan. 1986. A practical laboratory guide to the techniques and methodology of electrophoresis and its application to fish fillet identification. CSIRO Marine Laboratories Report 177. CSIRO, Melbourne, Australia. 59pp.

Milton, D.A. and J.B. Shaklee, 1987. Biochemical genetics and population structure of blue grenadier, Macruronus novaezelandiae (Hector)(Pisces: Merluciidae), from Australian waters. Aust. J. Mar. Freshw. Res. 38:727-742.

Salini, J. and J.B. Shaklee. 1988. Genetic structure of barramundi (Lates calcarifer) stocks from Northern Australia. Aust. J. Mar. Freshw. Res. 39:317-329.

Shaklee, J.B., F.W. Allendorf, D.C. Morizot, and G.S. Whitt. 1989. Genetic nomenclature of protein-coding loci in fish: Proposed guidelines. Trans. Amer. Fish. Soc. 118:218-227.

Lavery, S. and J.B. Shaklee. 1989. Population genetics of two tropical sharks, Carcharhinus tilstoni and C. sorrah, in northern Australia. Aust. J. Mar. Freshw. Res. 40:541-557.

Shaklee, J.B., C. Busack, A. Marshall, M. Miller, and S.R. Phelps. 1990. The electrophoretic analysis of salmonid mixed-stock fisheries. pp.235-265 In: (Z-I. Ogita and C.L. Markert, eds.) Isozymes: Structure, Function, and Use in Biology and Medicine (Proceedings of the Sixth International Congress on Isozymes). Progress In Clinical and Biological Research. Vol. 344. Wiley-Liss, Inc., New York. 973pp.

Shaklee, J.B., F.W. Allendorf, D.C. Morizot, and G.S. Whitt. 1990. Gene nomenclature for protein-coding loci in fish. Trans. Amer. Fish. Soc. 119:2-15.

Shaklee, J.B., S.R. Phelps, and J. Salini. 1990. Analysis of fish stock structure & mixed-stock fisheries by the electrophoretic characterization of allelic isozymes. pp. 173-196 In: (D.H. Whitmore, ed.) Applications of electrophoresis and isoelectric focusing techniques in fisheries management. CRC Press, Boca Raton, Fl.

Shaklee, J.B. and S. Phelps. 1990. Operation of a large-scale, multiagency genetic stock identification program. AFS Symposium 7:817-830.

Lavery, S. and J.B. Shaklee. 1991. Genetic evidence for separation of two sharks, Carcharhinus limbatus and C. tilstoni, from Northern Australia. Mar. Biol. 106:

White, B. and J.B. Shaklee. 1991. Need for replicated electrophoretic analyses in multiagency genetic stock identification programs (GSI): examples from a pink salmon (Oncorhynchus gorbuscha) GSI fisheries study. Can. J. Fish. Aquat. Sci. 48:1396-1407.

Shaklee, J.B., D.C. Klaybor, S. Young, and B.A. White. 1991. Genetic stock structure of odd-year pink salmon, Oncorhynchus gorbuscha, Walbaum, from Washington and British Columbia and potential mixed-stock fisheries applications. J. Fish Biol. 39(Supplement A):21-34.

Shaklee, J.B. and S.R. Phelps. 1992. Chinook salmon $NADP^+$-dependent cytosolic isocitrate dehydrogenase: Electrophoretic and genetic dissection of a complex isozyme system and geographic patterns of variation. Biochem. Genet. 30:455-489.

Shaklee, J.B., J. Salini, and R.N. Garrett. 1993. Electrophoretic characterization of multiple genetic stocks of barramundi perch in Queensland, Australia. Trans. Amer. Fish. Soc. 122:685-701.

Shaklee, J.B. and N.V. Varnavskaya. 1994. Electrophoretic characterization of odd-year pink salmon (*Oncorhynchus gorbuscha*) populations from the Pacific coast of Russia, and comparison with selected North American populations. Can. J. Fish. Aquat. Sci. 51(Suppl.1):158-171.

Shaklee, J.B. and P. Bentzen. 1998. Genetic identification of stocks of marine fish and shellfish. Bull. Mar. Sci. 62:589-621.

Papers In Press

Unrefereed Publications of Original Research, Reports, Symposia

Shaklee, J.B. and G.S. Whitt. 1979. Biochemical genetic markers as a taxonomic tool: dichotomy of lactate dehydrogenase patterns in gadiform fishes reveals an unnatural grouping. Statutory Meeting of the International Council for the Exploration of the Sea (C.M. 1979/F:38).

Shaklee, J.B. and P.B. Samollow. 1980. Genetic aspects of population structure of four species in the Northwestern Hawaiian Islands. pp. 264-277. In: (R.W. Grigg and R.T. Pfund, eds.) Proceedings of the

Symposium on Status of Resource Investigations in the Northwestern Hawaiian Islands. Sea Grant Miscellaneous Report UNIHI-SEAGRANT-MR-80-04.

Shaklee, J.B. and J.P. Salini. 1983. Studies suggest multiple stocks of Australian barramundi. Australian Fisheries 42(2): 36-38.

Shaklee, J.B. 1984. Family Albulidae (bonefishes); Albula neoguinaica; and Albula glossodonta. 7 pp. In: (W. Fischer and G. Bianchi, eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean; (Fishing Area 51). Vol. 1. FAO, Rome.

Salini, J., G. Rintoul, J. Shaklee and B. Phillips. 1986. An electrophoretic analysis of stock structure in the ornate tropical rock lobster, Panulirus ornatus. pp.218-228. In: (A.K. Haines, G.C. Williams, and D. Coates, eds.) Torres Strait Fisheries Seminar. Australian Government Publishing Service, Canberra. 344pp.

Salini, J. and J.B. Shaklee. 1987. Stock structure of Australian and Papua New Guinean barramundi (Lates calcarifer). pp. 30-34. In: (J.W. Copland and D.L. Grey, eds.) Management of Wild and Cultured Sea Bass/Barramundi (Lates calcarifer): Proceedings of an International Workshop held at Darwin, N.T., Australia, 24-30 September, 1986. ACIAR Proceedings No. 20. Ruskin Press, Melbourne. 210pp.

Salini, J. and J.B. Shaklee. 1987. Barramundi discoveries may change management. Australian Fisheries 46(1):2-6.

Shaklee, J.B., C. Busack, A. Marshall, and S. Phelps. 1989. Genetic stock identification analysis of three 1988 Washington ocean and Strait of Juan de Fuca chinook fisheries. Washington Department of Fisheries, Olympia, WA.

Shaklee, J.B., F.W. Allendorf, D.C. Morizot, and G.S. Whitt. 1989. Standardized nomenclature for protein-coding loci in fish. Fisheries 14(4):2-3

Shaklee, J.B. 1990. North American, odd-year pink salmon GSI baseline databases: Development, present status, and potential fishery applications. Proceedings of the Fourteenth Pink and Chum Workshop. Port Ludlow, Wa.

Shaklee, J.B. 1991. Simulation and other analysis of the 1991 Columbia River spring chinook GSI baseline. Technical Report 115 (40pp.), Washington Department of Fisheries, Olympia, WA.

Ryman, N., F. Utter, F.W. Allendorf, C. Busack, and J. Shaklee. 1993. Genetic concerns about hatchery populations -- A comment on the conclusions of Nyman and Ring. J. Fish Biol. 42:471-480.

Shaklee, J.B., C.A. Busack, and C.W. Hopley. 1993. Conservation genetics programs for Pacific salmon at the Washington Department of Fisheries: Living with and learning from the past, looking to the future. pp.110-141. In: K.L. Main and E. Reynolds (eds.) Selective Breeding of Fishes in Asia and the United States. Proceedings of a workshop in Honolulu, Hawaii May 3-7, 1993. The Oceanic Institute, Honolulu, HI.

Shaklee, J.B. and C. Marlowe. 1995. Conservation genetic issues and captive broodstock program design. Chapter 4, pp.21-29. In:(C.J. Smith and P. Wampler, eds.) Dungeness River chinook salmon rebuilding project progress report 1992-1993. NW. Fish. Resource Bull. Project Report Series #3.

Marlowe, C. and J.B. Shaklee. 1995. Alternatives considered for restoration of Dungeness chinook salmon. Chapter 5, pp.30-34. In:(C.J. Smith and P. Wampler, eds.) Dungeness River chinook salmon rebuilding project progress report 1992-1993. NW. Fish. Resource Bull. Project Report Series #3.

Shaklee, J.B., J. Ames, and D. Hendrick. 1995. Genetic diversity units and major ancestral lineages for pink salmon in Washington. Chapter B in: © Busack and J.B. Shaklee, eds.) Genetic Diversity Units and Major Ancestral Lineages of Salmonid Fishes in Washington. Tech. Rept. RAD 95-02. Washington Department of Fish and Wildlife, Olympia, Washington.

Shaklee, J.B., J. Ames, and L Lavoy. 1996. Genetic diversity units and major ancestral lineages for sockeye salmon in Washington. Chapter E in: © Busack and J.B. Shaklee, eds.) Genetic Diversity Units and Major Ancestral Lineages of Salmonid Fishes in Washington. Tech. Rept. RAD 95-02/96. Washington Department of Fish and Wildlife, Olympia, Washington.

Shaklee, J.B., J. Ames, and D. Hendrick. 1998. Conservation and management of pink salmon in Washington: Determining genetic diversity units. Proceedings 18th Northeast Pacific Pink and Chum Workshop. pp. 31-37.

White, B.A. and J.B. Shaklee. 1998. Marine migration patterns and proportions of adult Fraser River pink salmon in southern British Columbia and northern Washington fisheries. Proceedings 18th Northeast Pacific Pink and Chum Workshop. pp. 14-30.

Habicht, C. J.B. Shaklee, J.E. Seeb, L.W. Seeb, W.D. Templin, and B.M. Baker. 1998. Genetic structure of even-year pink salmon inhabiting Prince William Sound, Alaska: Allozyme and mtDNA data. [18th Northeast Pacific Pink and Chum Workshop. [*extended abstract only*].

Seeb, J.E., C. Habicht, J.B. Olsen, P. Bentzen, J.B. Shaklee, and L.W. Seeb. 1998. Allozyme, mtDNA, and microsatellite variants describe structure of populations of pink and sockeye salmon in Alaska. North Pacific Anad. Fish Comm. Bulletin 1:300-318.

Manuscripts Submitted or in Preparation

Shaklee, J.B., T.D. Beacham, L. Seeb, and B.A. White. 1998. Managing Pacific salmon fisheries using genetic data: Case studies for chinook, pink, chum, and coho salmon in North America. Fish. Res. [Submitted].

Shaklee, J.B. and K. Currens. Genetic Stock Identification and Risk Assessment. Chapter ## In: (E. Hallerman, ed.) Genetic Principles and Practices for Fisheries Scientists. Amer. Fish. Soc. Washingon D.C. [*IN MANUSCRIPT; 32pp.*]

Seeb, J.E., C. Habicht, W.D. Templin, L.W. Seeb, J.B. Shaklee, and F.M., Utter. 1998. Ecologically important genetic structure of even-year pink salmon inhabiting Prince William Sound Alaska based on allozyme and mtDNA data. Ecol. Freshw. Fish. (In Prep.).

Shaklee, J.B. An electrophoretic analysis of genetic variation and stock structure in narrow-barred Spanish mackerel, Scomberomorus commerson, in Australia, the Torres Strait, and southern Papua New Guinea. [*IN MANUSCRIPT*]

Shaklee, J.B. Genetic variation and population differentiation in the narrow-barred Spanish mackerel, Scomberomorus commerson, throughout the Indo-west Pacific. [*IN MANUSCRIPT*]

Postdoctoral Research - University of Illinois

Supervisor: Dr. Gregory S. Whitt

a) LDH isozyme evolution in fishes

b) Enzymatic differentiation during fish development

c) Enzymatic mechanisms of temperature acclimation in fishes

University of Hawaii

a) Analysis of genetic aspects of stock structure of marine organisms in the Hawaiian Archipelago

b) Biochemical and morphological analysis of speciation and

evolution in the bonefish (Albula)

c) Investigation of sex linkage and sex ratio in a spiny lobster

CSIRO, Australia

a) Determination of genetic aspects of stock structure in commercially-important fish and invertebrates (including: narrow-barred Spanish mackerel, barramundi, two species of carcharinid sharks, blue grenadier, and a tropical rock lobster)

b) Development and testing of biochemical methodologies for the identification of fish fillets and other processed seafood products.

Section 10. Information/technology transfer

The general principles governing this proposal include: projects to help reduce uncertainties; priorities that reflect system wide analysis of major uncertainties; BPA and other funding to be consistent with key uncertainties; knowledge to be reviewed by fish managers and made available to others; fish managers will participate in development and implementation of monitoring and management programs. This projects to be coordinated with activities of others. Fish managers should evaluate the program in conjunction with independent peer review, although the fish managers should continue to work with the Scientific Review Group, the independent scientific group established by BPA as part of its implementation and funding process is a likely candidate. Publication and wide dissemination of the results from this project will be an inherent objective and task.

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